



Chapter 18 Magnetism

Physical Science



Magnets

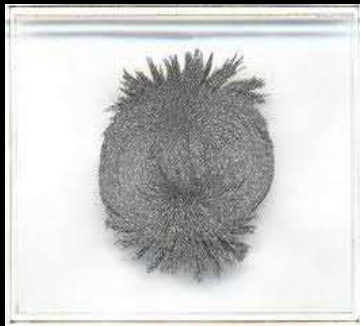
Magnet – any material that attracts iron and materials that contain iron

- **Magnetism** – the attraction or repulsion of magnetic materials
- Magnets attract or repel other magnets.



- Today, the word **magnetism** refers to the properties and interactions of **magnets**.

Common metals affected by magnetism are iron, nickel, and cobalt

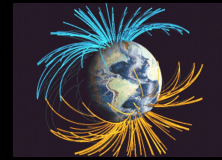


IRON



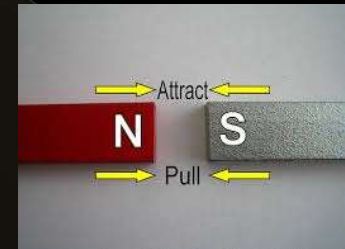
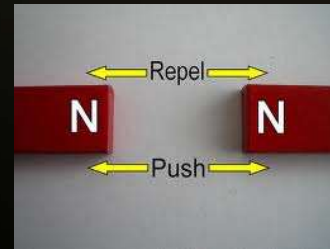
NICKEL

Magnetic Poles



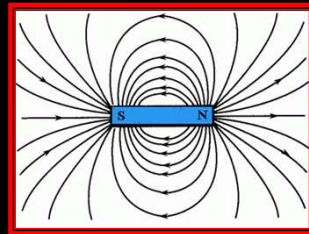
○ Magnetic poles that are alike repel each other.

○ Magnetic poles that are unlike attract each other.



Magnetic Fields

- A magnet is surrounded by a magnetic field.
- A magnetic field exerts a force on other magnets and objects made of magnetic materials.
- The magnetic field is strongest close to the magnet and weaker far away.

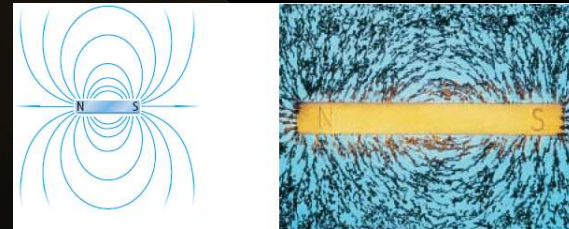


A magnetic field also has a direction & illustrated by arrows.

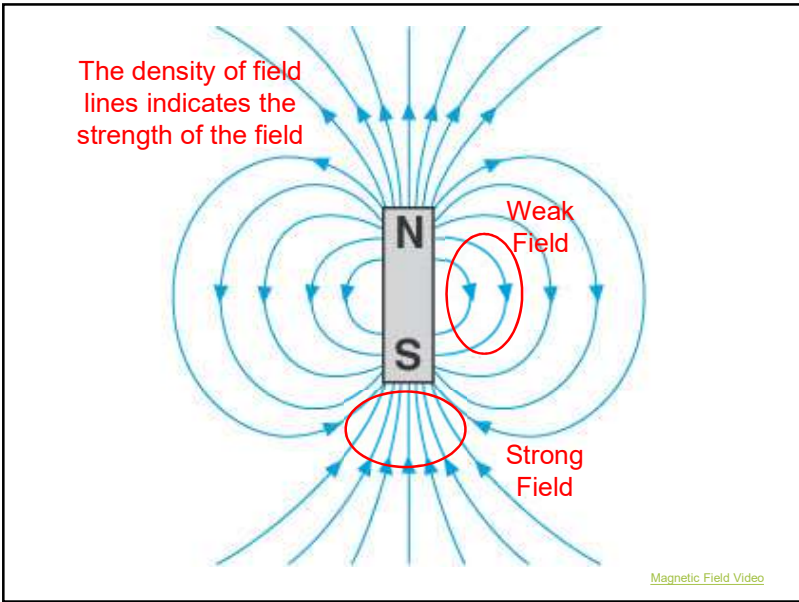
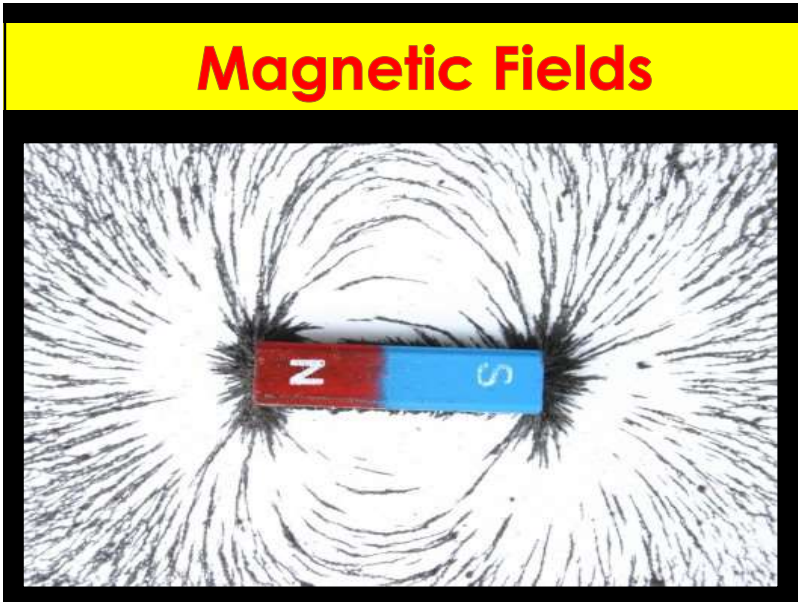


Magnetic Fields

- magnetic field lines – the lines that map out the magnetic field around a magnet



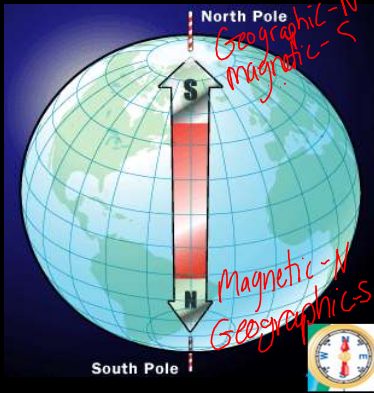
Magnetic field lines spread out from one pole, curve around the magnet, and return to the other pole forming a closed loop.



Earth as a Magnet

➤ **Magnetic poles of the Earth are different from the geographic poles of the Earth**

- the **North Magnetic Pole** is located near the geographic **South Pole**
- the **South Magnetic Pole** is located near the geographic **North Pole**



Electromagnetism

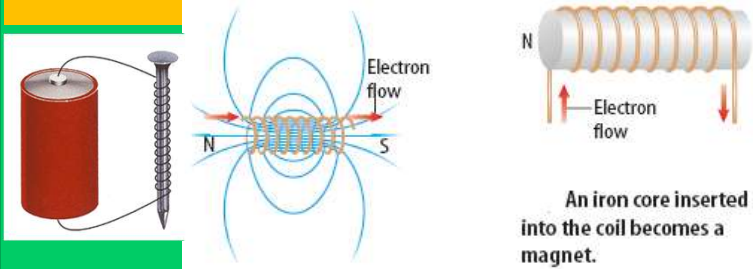
- Electric current must produce a magnetic field around the wire, and the direction of the field changes with the direction of the current.
- **Electromagnetism** – relationship between electricity and magnetism



Electromagnetism

When an electric current is passed through a coil of wire wrapped around a metal core, a very strong magnetic field is produced. This is called an **electromagnet**.

The strength depends on the number of turns in the coil, the amount of current, and the size of the iron core.



YOU CAN MAKE AN ELECTROMAGNET

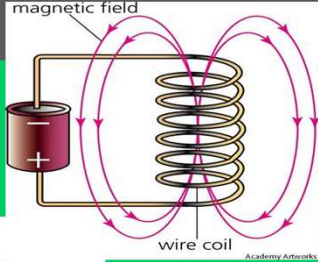


Electromagnets can be turned on and off. You can make an electromagnet by wrapping a wire around a piece of iron and sending a current through the wire with a battery.


Electromagnetism

- A single wire wrapped into a cylindrical wire coil is called a solenoid.
- A type of electromagnet

- The solenoid's magnetic field magnetizes the iron core.



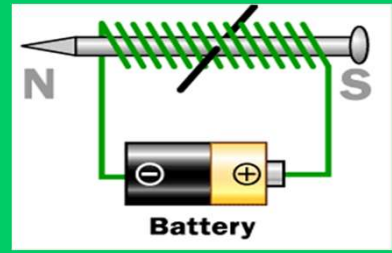
The diagram shows a battery connected to a wire coil. Purple magnetic field lines are shown circulating around the coil. Labels include 'magnetic field' and 'wire coil'. A small credit 'Academy Artworks' is visible at the bottom right of the diagram.



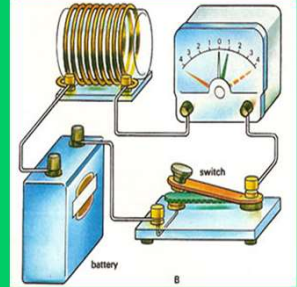
A photograph of a physical solenoid, which is a cylindrical coil of wire with electrical leads extending from it.

Electromagnetism

- The magnetic field inside the solenoid with the iron core can be more than 1,000 times greater than the field inside the solenoid without the iron core.



The diagram shows a solenoid with an iron core (a nail) inserted through it. The core is labeled with 'N' (North) and 'S' (South) poles. A battery is connected to the solenoid. The word 'Battery' is written below the battery.



A circuit diagram showing a solenoid connected to a battery, a switch, and a meter. The battery is labeled 'battery' and the switch is labeled 'switch'. The meter has a scale from 0 to 10.

Electromagnetism

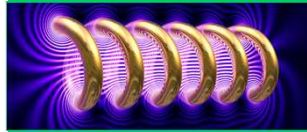
Properties of Electromagnets

- Electromagnets are temporary magnets because the magnetic field is present only when current is flowing in the solenoid.



- The strength of the magnetic field increases:

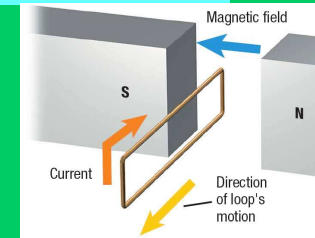
- by adding more turns of wire to the solenoid
- by increasing the current passing through the wire.



Electromagnetic Induction

The process of inducing a current by moving a magnetic field through a wire coil without touching it.

Causes charges to move within the wire.



Electromagnetic Induction

Generators

- electric generator – a device that converts mechanical energy into electrical energy
- A generator uses motion in a magnetic field to produce an electric current

